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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/387,857 | 09/01/1999 | FUMITAKA SUGAYA | 1776/00039 | 3099 |

7590

02/06/2003

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EXAMINER

NOVACEK, CHRISTY L

| ART UNIT | PAPER NUMBER |
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2822

DATE MAILED: 02/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/387,857

Applicant(s)

SUGAYA, FUMITAKA

Examiner

Christy L. Novacek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 November 2002 and 23 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 28-36, 38-42, 44 and 45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28-31, 42, 44 and 45 is/are allowed.
- 6) ☒ Claim(s) 32-36 and 38-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 14 June 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/059,590.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This Office Action is in response to the amendment filed November 25, 2002 and the request for continued examination and preliminary response filed December 23, 2002.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on November 25, 2002 and December 23, 2002 have been entered.

Drawings

The proposed drawing corrections filed on June 14, 2002 have been approved. A proper drawing correction or corrected drawings are **required** in reply to the Office action to avoid **abandonment** of the application. The correction to the drawings will **not** be held in abeyance.

Response to Amendment

The amendment of claim 32 is sufficient to overcome the rejection of claims 32-35 under 35 U.S.C. 112, first paragraph and the objection to the specification recited in the previous Office Action. Therefore, this rejection and objection are withdrawn.

The amendment of claim 42 is sufficient to overcome the rejection of claims 42, 44 and 45 under 35 U.S.C. 112, second paragraph recited in the previous Office Action. Therefore, this rejection is withdrawn.

The limitations added to claim 42 are sufficient to overcome the Schoenfeld et al. (US 6,010,932) reference. Therefore, the rejections of claims 42 under 35 U.S.C. 102(e) and claims 44 and 45 under 35 U.S.C. 103(a) are hereby withdrawn.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 32-34 and 36 are rejected under 35 U.S.C. 102(e) as being anticipated by Schoenfeld et al. (US 6,010,932, previously cited).

In reference to claims 32 and 33, Schoenfeld discloses forming an element active region and an element isolation structure (104) on a semiconductor substrate (102) (Fig. 1; col. 4, ln. 19-23). A gate oxide film (106) and a gate electrode (116) are formed in the active region and an impurity is doped into the substrate in the active region to form a pair of impurity diffusion layers (108/110) in the surface of the substrate on two sides of the gate electrode (Fig. 1; col. 4, ln. 23-31). An insulating interlayer film (120/126) is formed on the entire surface of the substrate. A hole is formed in the insulating interlayer film such that one of the impurity diffusion layers is exposed. A first conductive film (128) film is deposited onto the insulating interlayer film such that it fills the hole in the interlayer film and is electrically connected to one of the impurity diffusion layers (col. 4, ln. 55-58). A mask pattern (130) having first (142) and second (140) openings is formed on the first conductive film and the mask is used to divide the

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first conductive film below the first opening while simultaneously forming a recess in the first conductive film below the second opening such that the first conductive layer forms a bottom of the recess (Fig. 2-3; col. 4, ln. 61-col. 5, ln. 15). A dielectric film (134) covers the surface of the first conductive film and a second conductive film (136) covers the dielectric film (Fig. 4; col. 5, ln. 16-21).

In reference to claim 34, Schoenfeld discloses that the second openings (142) may be of any size so long as the width of the first openings (142) greater than the width of the second openings (140) (col. 4, ln. 66-col. 5, ln. 15). Specifically, Schoenfeld states, "It is, of course, understood that the apertures 140 can be of any shape (circular, triangular, rectangular, etc.), size, and/or dimension to achieve a desired surface area on the storage poly nodes 132." (col. 5, ln. 11-15)

In reference to claim 36, Schoenfeld discloses a first conductive film (128) is formed in an insulating film region (126) on a semiconductor substrate (102) (Fig. 1). A mask pattern (130) having two openings (140/142) of different dimensions is formed on the first conductive film and the mask is used to divide the first conductive film while it is conformed to a shape of one of the openings (142) and at least one recess is simultaneously formed while the surface of the first conductive film is conformed to the shape of the other opening (Fig. 2-3; col. 4, ln. 61-col. 5, ln. 15). An insulating film (134) covers the surface of the first conductive film and a second conductive film (136) covers the insulating film (Fig. 4; col. 5, ln. 16-21).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schoenfeld et al. in view of Wolf (Vol. 2, previously cited).

In reference to claim 35, Schoenfeld discloses that the second opening of the mask pattern is positioned above the element active region (Fig. 2). Schoenfeld does not disclose planarizing the first conductive layer by polishing. Wolf (Vol. 2) discloses that when photolithography is used to pattern IC features, it is required that the imaging surface to be etched is very flat in order to obtain the maximum resolution from the photolithography etching process (last paragraph pg. 65, pg. 203). The Examiner takes official notice that chemical mechanical polishing is a well-known and conventional method in the art for providing planarization of films. At the time of the invention, it would have been obvious to one of ordinary skill in the art to planarize the first conductive layer of Schoenfeld because, as Wolf teaches, it is required that an imaging surface be planar when it is to be subjected to a photolithographic process in order to achieve the maximum resolution from the etching process. Furthermore, it would have been obvious to one of ordinary skill in the art to conduct the planarization using a polishing technique because it is a conventional method of planarization.

Claims 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komori et al. (US 5,300,802, previously cited) in view of Wolf et al. (Vol. 1, previously cited).

In reference to claim 38, Komori discloses a first step of forming element active regions and element isolation structures (4) on a semiconductor substrate (1) (Fig. 2). A second step comprises forming an insulating film (6) on the substrate in the element active region (Fig. 2). A third step comprises forming a first conductive film (7A) on an entire surface including the

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insulating film and the element isolation structure (col. 8, ln. 7-11). In a fourth step, the first conductive film is patterned such that element isolation regions are exposed (Fig. 3, col. 8, ln. 14-15). Next, a dielectric film (8) is formed so as to cover the first conductive film and a second conductive film (9A) is formed on the dielectric film (Fig. 4; col. 8, ln. 21-35). Komori does not disclose the particular steps involved in patterning the first conductive layer. Wolf discloses that the conventional method of patterning a film in semiconductor device fabrication is by photolithography, wherein a mask is formed on the film to be etched, a pattern of openings is formed in the mask by selective light irradiation, and the film is etched in the portions exposed by the mask pattern (pg. 407-408). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use a conventional photolithography process to pattern the first conductive film of Komori because, in the absence of the disclosure of any particular process, one of ordinary skill in the art would look to use a conventional process to accomplish the patterning. Using a conventional photolithography process to pattern the first conductive film of Komori would involve forming a mask having at least first and second openings on the first conductive film and etching the first conductive film in the regions exposed by the openings. As can be seen in Fig. 3, the first conductive film is patterned such that element isolation regions are exposed in the areas from which the first conductive is etched away.

In reference to claim 39, after the second conductive layer is deposited, Komori discloses doping an impurity into the substrate in the element active regions to form a pair of impurity diffusion regions (11n/12n/13p/14n) on each side of the first conductive film (Fig. 6; col. 8, ln. 57-col. 9, ln. 25).

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Komori et al. in view of Wolf et al. (Vol. 1), as applied to claim 38 above, and further in view of Wolf (Vol. 2, previously cited).

In reference to claim 40, Komori does not disclose planarizing the first conductive layer by polishing. Wolf (Vol. 2) discloses that when photolithography is used to pattern IC features, it is required that the imaging surface to be etched is very flat in order to obtain the maximum resolution from the photolithography etching process (last paragraph pg. 65, pg. 203). The Examiner takes official notice that chemical mechanical polishing is a well-known and conventional method in the art for providing planarization of films. At the time of the invention, it would have been obvious to one of ordinary skill in the art to planarize the first conductive layer of Komori because, as Wolf teaches, it is required that an imaging surface be planar when it is to be subjected to a photolithographic process in order to achieve the maximum resolution from the etching process. Furthermore, it would have been obvious to one of ordinary skill in the art to conduct the planarization using a polishing technique because it is a conventional method of planarization.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Komori et al. in view of Wolf et al., as applied to claim 38 above, and further in view of Eaton, Jr. et al. (US 4,570,331, previously cited)

In reference to claim 41, Komori discloses forming element isolation regions (4) by performing field oxidation (Fig. 1; col. 7, ln. 64-67). Eaton also discloses a method of forming element isolation regions. However, Eaton teaches that by using field shield isolation structures instead of field oxidation regions, the space between element active regions can be decreased,

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thereby decreasing the overall size of the semiconductor device (Fig. 3; col. 2, ln. 46-col. 3, ln. 42). Eaton also teaches that this decrease in the space between adjacent element active regions provides “a significant advantage” over the typical field oxidation process (col. 4, ln. 62-68). At the time of the invention, it would have been obvious to one of ordinary skill in the art to substitute the field shield isolation structures of Eaton for the field oxide regions of Schoenfeld because Eaton teaches that field shield isolation structures are superior to field oxidation regions for the purpose of forming element isolation regions because the field shield structures allow the space between adjacent element active regions to be decreased.

Response to Arguments

Applicant's arguments filed November 25, 2002 and December 23, 2002 have been fully considered.

Regarding claim 36, Applicants argue that the Schoenfeld reference does not disclose dividing the first conductive film to conform to a shape of one of the openings until the insulating film is reached. However, the recesses 144 of Schoenfeld meet the claim limitation of “at least one recess in a surface of said divided first conductive film”, while the openings in the first conductive layer which separate adjacent capacitors (NOT recesses 144) meet the claim limitation of “dividing said first conductive film conforming to a shape of one of said openings so as to reach said insulating film region”.

Regarding the rejection of claims 38 and 39 under 35 U.S.C. 103(a) as being unpatentable over Komori in view of Wolf (Vol. 1), Examiner maintains that the references, in combination, meet all limitations recited in the claim. Applicants argue, “[T]he feature of using the element isolation structure as a stopper to divide the first conductive film below the first

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opening, and simultaneously forming a hole below the second opening, does not appear to be disclosed in either reference.” Komori discloses that the first conductive film (7A) is formed by depositing a silicon film “on the whole substrate surface” and then it is “patterned into a predetermined shape”. Komori does not disclose what type of process is to be used for patterning the silicon film into the predetermined shape. The Wolf reference is combined with the Komori reference because Wolf discloses that the conventional method of patterning a film in semiconductor device fabrication is by photolithography, wherein a mask is formed on the film to be etched, a pattern of openings is formed in the mask by selective light irradiation, and the film is etched in the portions exposed by the mask pattern. Neither the Komori reference nor the Wolf reference suggests any reason to etch the openings in a way other than simultaneously.

Allowable Subject Matter

Claims 28-31, 42, 44 and 45 are allowed.

The primary reasons for the allowance of claims 28-31 is the inclusion therein, in combination as currently claimed, of the limitation of forming a mask pattern on a conductive film that is used to etch the conductive film such that in a first region, the element isolation structure is exposed while, simultaneously, a recess is etched into the first conductive film wherein a portion of the first conductive film remains on the bottom of the recess. This limitation is found in claims 28-31 and is neither disclosed nor taught by the prior art of record, alone or in combination.

The primary reason for the allowance of claims 42, 44 and 45 is the inclusion therein, in combination as currently claimed, of the limitation of dividing the first conductive film below

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the first opening while simultaneously forming a cylindrical hole extending through the first conductive film below the second opening. This limitation is found in claims 42, 44 and 45 and is neither disclosed nor taught by the prior art of record, alone or in combination. The Schoenfeld reference discloses that the hole extending through the first conductive film below the second opening is in the shape of an avenue across the surface of the insulating film.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (703) 308-5840. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

CLN
February 4, 2003


AMIR ZARABIAN
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